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VOL. VII
TECH.OPNS. IN THE WEST
OF THE LUFTWAFFE SIS

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THE SIGNAL INTELLIGENCE SERVICE
OF THE
GERMAN LUFTWAFFE

VOL. VII

TECHNICAL OPERATIONS IN THE WEST

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VOL. VII

TECHNICAL OPERATIONS IN THE WEST OF THE LUFTWAFFE SIS

By

Lieutenant Martin Ludwig
Chi-Stelle, Luftwaffe SIS.

F O R E W O R D

1. Within this volume is contained a summary of the technical operations of the Luftwaffe SIS in the West.
2. This study, perhaps more than any other contained within the overall record of the operations of the Luftwaffe SIS, reveals the detailed knowledge it possessed of the RAF and USAAF, and the cunning techniques of interception and evaluation by which it acquired that knowledge.
3. It may readily be suspected on the part of those who read this study, that the author was assisted in its preparation at least by hints from those of our own SIS officers under whose supervision he compiled the work. This is not true in the slightest degree. On the contrary the study was drawn entirely from memory, there being even no Luftwaffe records available for reference.
4. Lieutenant Ludwig of course consulted freely with his fellow officers of the Luftwaffe SIS of the West who were at hand, and they assisted in the final draft of the German text. In this connection mention must be made especially of the contribution of Technical Sergeant Gerd Watkinson, who served for a long time as duty officer in the operational room of Meldekopf 1, and who himself re-wrote in entirety the sections treating with the RAF Bomber Command and the VIII Bomber Command of the Eighth Air Force, USAAF.

*Paragraphs and extracts
marked with red asterisk
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Lieutenant Martin Ludwig
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TECHNICAL OPERATIONS IN THE WEST
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A. General

While signal intelligence on other battle fronts, such as the East, gained most important intelligence from intercepted messages, the West depended mainly on traffic and log analysis, cryptanalytic results being rather meager. Difficulties were increased by the fact that, until the start of the invasion, the communications of Allied Air Force units, stationed in Great Britain, depended mainly on wire.

In spite of these difficulties signal intelligence in the West always had a good over all picture of the organization, strength and tactics of the Allied Air Forces after overcoming various obstacles existing at the beginning of the war, such as inept section chiefs, inexperienced personnel, and antiquated methods. So, during the course of the war, it grew to be the most important source of information to the Command. German signal intelligence was greatly aided by the use of fixed frequencies and call-signs by the RAF and the USAAF.

B. Use of Frequencies and Call-Signs in W/T

1. Use of Call-Signs and their Identification

The ground stations of the RAF and USAAF had fixed call-signs consisting of:

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Number-Letter-Letter (3ob)
Letter-Number-Letter (o3b)
Letter-Letter-Number (ob3)

The ground stations of the ARAF (2nd TAF, 9th AF, 1st TAF (Prov.)) had Letter-Number-Number (e.g. a83 = 9th AF).

RAF call-signs comprised only the figures 1, 3, 5, 6, 7, 8, 9, and the figures 0, 2, 4 appeared only in the so-called "delivery groups".

The call-signs were changed on the average of twice a year. No general change of call-signs took place within the ARAF from May 1944 until the end of the war.

All analysts agreed that, if periodical changes in call-signs and frequencies, for instance every 10 days, had been introduced by the Allies, the task of German signal intelligence would have been much more difficult.

The few changes in call-signs had practically no security effect, because the frequencies were not changed at the same time, and most radio stations could be identified immediately. Usually it was sufficient to identify a radio station only once. When a call-sign was identified the tactical organization in question could be, with a little alertness, continuously traced and its location and assignment recognized.

The identification of unknown W/T traffic was achieved for the most part in the following manner:

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cc) At the same time it became known through interception of HF R/T traffic (frequency approximately 5100 kcs.) that, at the Fulbeck airfield near Cottesmore, frequent training flights of glider-towing C-47's took place. The cover-name of Fulbeck was known from captured documents, and the location was confirmed by D/F. In intercepting this traffic the following messages could be heard frequently:

"Have you the glider in tow?"

"There are 3 C-47's with gliders in tow."

On several days, details of these training operations, for example experiments to determine maximum loads for gliders, had been intercepted.

The following became evident:

- aa) The organization in question was American, strength approximately 1000 planes, consisting partly or entirely of C-47's;
- bb) The organization was part of the 9th Air Force;
- cc) Training in glider-towing was being carried out;
- dd) Three units were subordinated to this organization, one of them presumably the 50th Wing. As the 51st Wing, located in Italy, was known to be a transport wing, it was assumed that the 50th Wing also was a transport unit;
- ee) Since one of the subordinate units was a "wing", the higher headquarters could be presumed to be a "command".

This new organization was thereupon designated by the Luftwaffe SIS as the

"IX Transport Command"

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Later, after the right name, the "IX Troop Carrier Command", became known through agents and captured documents, the only change necessary was one of nomenclature; all other conclusions were correct.

b) Reconstruction of RAF Training Command Network

One of the radio stations in the command network of the British Air Ministry was picked up, and its identity was established by collection of the following evidence:

- aa) The radio station was monitored and was found to be the net control station of several subordinate networks;
- bb) One of these subordinate networks was D/F'ed. Most of the radio stations proved to be on the coast;
- cc) Comparison with British air maps on hand showed that the location of the out-stations of the subordinate network were, for the most part, identical with the "Air Bombing" or "Air Gunnery" ranges.

Wherever bombing or air gunnery ranges were located, over which flying was forbidden, there were also respective RAF radio stations. These could only represent bombing or air-gunnery schools. The net control station therefore had to be either under the Training Command, or was the Training Command Headquarters itself. It was easy to identify the other networks of the same command and, later on, to report current changes, for example, moving of schools out of Great Britain.

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2. Changing of W/T Call-Signs

Change of call-signs seldom came as a surprise. If several months passed and no change of call-signs occurred, preparations were made to counteract the effect of the anticipated change. This was done by instructing intercept and evaluation personnel, by permitting no change in intercept personnel or the frequencies covered, in order that each intercept operator be familiar with the peculiarities of one network. After a change in call-signs, it was usually possible within 24 hours to identify 30-40% of the new call-signs, and in any case the HQ stations. The best radio and D/F personnel was always used for identification work. The effectiveness of their work was increased by special furloughs and other privileges when exceptionally good results were obtained. Recognition of radio stations, after changes in their call-signs, was determined in various ways for example:

- a) The British or American W/T operator, accustomed to his old call-sign over a period of months, slips, sends his old call-sign "r7u", corrects it to "5fz", and thereby reveals the change;
- b) The radio operator starts by mistake, with the old call-sign "r..", sends "e's" to correct his mistake, followed by the new call-sign "5fz". The experienced intercept operator knows immediately, that "r7u" has changed to "5fz", because "r7u" was the only station of the particular network that started with "r";
- c) Many radio stations, especially headquarters transmitters, were recognized by their tone;
- d) Ground stations would use their old call-signs in one network and their new ones in another;

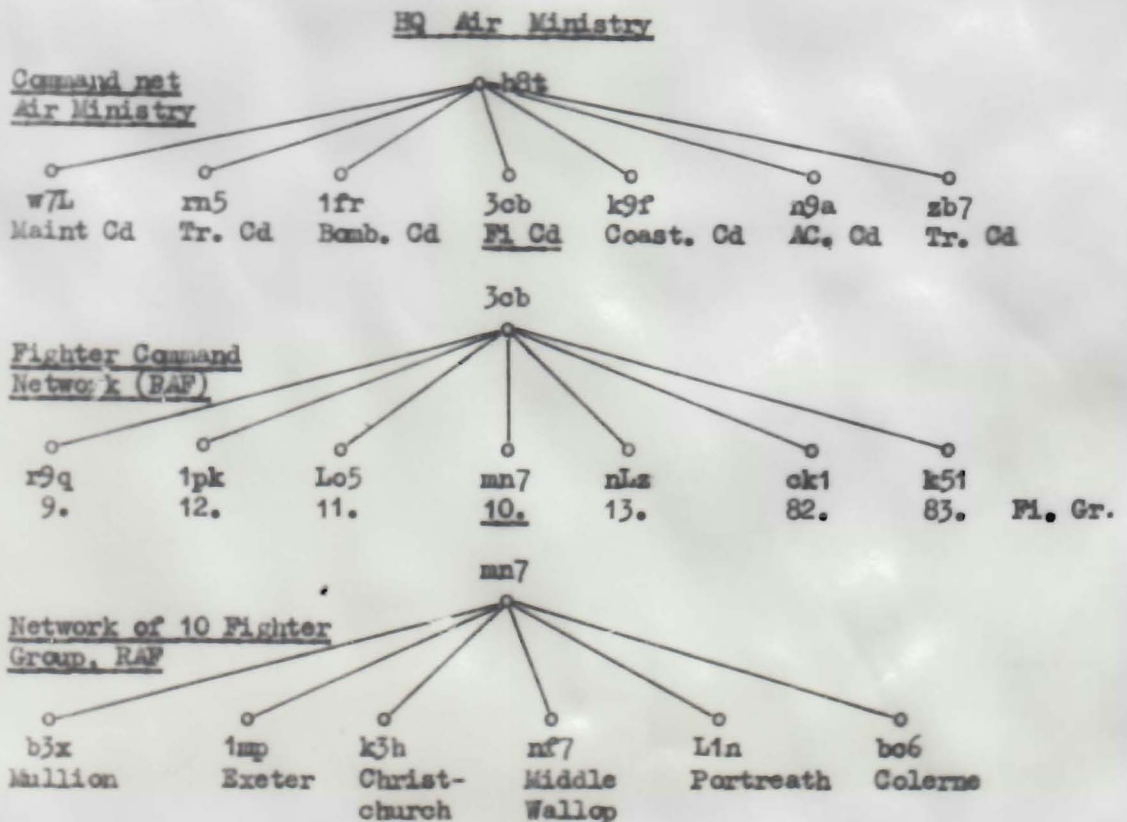
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e) Frequently aircraft called ground stations, using their old call-signs, and were answered with the new call-signs.

When, in a network of five or more stations, the control station and several out-stations were identified, the remainder could be easily located by D/F.

3. Determining Chain of Command From the Use of W/T Call-Signs

In the RAF, and to some extent in the USAAF, out-stations of one network appeared as control stations in subordinate networks, using the same call-sign. Because of this the chain of command could be rapidly determined, as the diagram below shows (Call-signs are fictitious as original call-signs are no longer remembered).



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4. Advanced Echelon Call-Signs (W/T)

A continual source of information was the appearance of so-called advanced echelon call-signs. If, for example, station "c13" began radio communication with "c13a" or "c131", it was evident that the latter was an advanced echelon of "c13". Thus numerous changes in order of battle, movement of units, and preparations for new attacks were recognized. The same rule applied when there suddenly appeared the call-sign of an advanced headquarters where formerly the "rear" or "main" headquarters only had been heard.

Examples:

The transfer of Advanced Hq. of 9th Air Force (a83) from Luxembourg to a more northern location, coinciding with the reappearance of Advanced Hq., ARAF in the area of Reims, was taken as a final indication of the imminent beginning of the decisive Allied offensive in February, 1945.

C. Use of R/T Call-Signs and Frequencies

1. R/T Call-Signs.

The British and American R/T call-signs, which hardly differed from each other in their structure, consisted mostly of two or three syllable words, which could be easily distinguished phonetically. (Fabricated words like "Handy", "Ripsaw", "Canway" were preferred). The call-signs were fixed and changed, (at first, once a year, later semi-annually or quarterly). The call-sign itself did not give any hint as to whether it belonged to a ground station or to a flying unit, but this could be easily determined from the traffic, and from the additions to the call-signs.

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a) Ground Station Call-Signs

They appeared generally without additional signs, or with the additional word "Control" (Beetle Control), or "Ground" (Icecold Ground). Auxiliary stations used the call-sign of the main station with the addition of figures or letters (Ripsaw 1, 2, 3; Longbow A, B, C). The following groups of ground-stations in the West were known:

aa) Sector Control Stations.

Command posts for fighter control, located in England, which directed the British fighter units in their sector, mainly for defense. Later on, they directed escort units for heavy bomber formations.

bb) Main Command Posts

Control stations which directed all units of an British Group or an American TAC in defense and attack (Longbow = 84th Fighter Group; Sweepstakes = IX. TAC).

cc) Airfield D/F Stations (Fixer World Wide Guard).

VHF D/F stations at an airfield which gave heading instructions to aircraft of all groups and commands (Bluefrock = Manston).

dd) Group D/F Stations (USAAF = Group-Control; RAF = Airfield-Control):

VHF D/F stations, which were an integral part of a flying unit and always moved with their unit. They gave heading bearings and course to aircraft of their respective groups.

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ee) Fighter Control Stations (Ground Control Interception).

Control stations which directed all aircraft within range of their radar (GinFizz, Ripsaw 1, 2, etc.).

ff) Radar Stations.

Were not control stations, but simply radar stations. They sent radar reports on VHF concerning allied and enemy aircraft in the area of the 1st U.S. Tactical Air Force (Provisional). At 9th AF and 2nd TAF these reports were given in W/T or R/T on HF.

gg) ASP's and Tentacles.

Air Force liaison teams at Army Headquarters.

b) Aircraft Call-Signs

An R/T call-sign usually represented a squadron, but also was sometimes used by larger units such as British wings and American groups; and within the 8th AF, even for combat wings and divisions. However, the most frequently used call-sign was, at least in the tactical air forces, the squadron call-sign. The section used the squadron call-sign plus the name of a color (Gaysong red). A single aircraft used either the section call-sign plus a figure ("Gaysong red" 1, 2, 3) or the squadron call-sign plus the number of the pilot ("Gaysong" 42). The RAF squadron leaders, wing commanders and group commanders used either their own call-signs or the call-sign of their unit plus the word "leader" ("Gaysong-Leader"). The systems for allocating call-signs were varied:

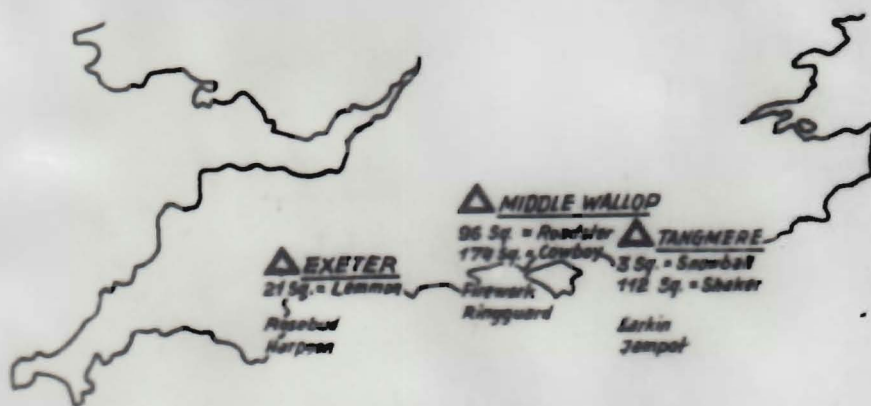
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aa) British Fighter Command.

Call-signs were assigned to a sector, sometimes even to an airfield. When a squadron moved, it took over the call-sign of the new air base. By this very simple method it was almost impossible for the movements of certain squadrons to be detected through signal intelligence. In contrast to this, the strength and locations of fighter units could be simply determined by a card file containing the call-signs, which appeared during a certain period.

Example of Squadron Movements Within the RAF Fighter Command.

(all dates are fictitious)



Explanation: Until April 15, the call-signs heard were Exeter (Lemon), 2 call-signs at Middle Wallop (Roadster, Cowboy), and 2 call-signs at Tangmere (Snowball, Shaker). On April 15 the 174th Squadron transferred to Tangmere and there adopted the call-sign "Larkin"; the 3rd Squadron moved to Exeter and used the call-sign "Rosebud". The squadron movements could not be

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recognized in detail, but it was observed that from April 15th on, only one call-sign appeared in Middle Wallop (Roadster), meaning that only one squadron was there. At Tangmere, 2 call-signs were heard (Shaker, Larkin); at Exeter, 2 call-signs (Lemon, Rosebud). In this way strength and location were always known.

bb) British 2nd TAF.

The call-sign allocation was not bound by fixed rules. Sometimes the call-sign was assigned to a squadron, in which case the transfer of a squadron from one airfield to another could very easily be recognized by the appearance of the call-sign of this squadron on the frequency of the new airfield. The airfields had also a number of reserve call-signs, which were occasionally allocated to the subordinate squadrons. Changes in the chain of command could therefore not always be recognized, but an estimate of the strength could be easily made at any time, in the same manner as with the Fighter Command.

cc) American Fighter Units.

When the 8th AF was first heard, there was considerable difficulty in identifying call-signs, due, not to the system of assigning call-signs, but to the inexperience of the German SIS service in this field. At first the SADR receiver, used by the Luftwaffe SIS, did not extend higher than 120 mc/s. Meanwhile American R/T traffic started only at 125 mc/s. The only American R/T frequency within the range of these sets was that of the Air Sea Rescue Service. Later, when a modified

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SADIR receiver was introduced, having a frequency range up to 180 mc/s, this difficulty was overcome.

Before long the very simple allocation system for American call-signs was recognized. Each group, consisting of three squadrons, had its call-sign, as did each squadron within the group. To recognize the strength was therefore very simple, and the change of call-signs and appearance of new organizations (for example, the 9th USAAF) never caused great difficulties.

dd) British Medium Bomber Units (2 Bomber Group).

Use of call-signs differed. In part the call-signs were fixed (Mosquito squadrons); in other cases they changed with each operation (Boston and Mitchell units). Owing to good radio discipline and comparatively few operations, the identification of call-signs presented difficulties.

ee) American Medium Bomber Units (IXth Bomber Command).

The "Marauder", "Havoc" and "Invader" units used changing operational call-signs with figures added (during the last period colors, instead of figures were added) for the combat boxes. The call-sign system was very clever and was not solved by German signal intelligence. Nevertheless, strength could still be determined by the manner in which frequencies were used.

The call-sign system of the medium bomber units of 1st USAF (Prov.) was mixed. Neither its fixed call-signs nor its operational call-signs caused any difficulty.

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ff) RAF Bomber Command.

Only Mosquito units used VHF. Their signal security was so efficient that no substantial amount of intelligence could be obtained from monitoring this traffic.

gg) American Heavy Bomber Units (8th USAAF).

Fixed call-signs for squadrons, combat wings and divisions were used. In contrast to other units, squadron call-signs were used very rarely. Wing call-signs, with colors to designate the combat wings, predominated. In traffic between bombers and their escort collective call-signs were the rule (Vinegrove-Balance, with figures attached). No difficulties were encountered in identifying the call-signs.

2. Use of R/T Frequencies.

At the start of the war the RAF transmitted on HF (3000 - 6500 Kc/s). In Autumn 1940 the change to VHF (Radio Set 1133) took place. This presented great difficulties for the German SIS because of the following circumstances:

- a) Lack of appropriate receivers;
- b) Lack of experience in VHF;
- c) The special propagation properties of VHF waves. These conditions of propagation prevented the centralization of interception and required many intercept platoons, located in favorable sites, in order to hear as much traffic as possible. By this decentralization difficulties arose in evaluation as final evaluation could not be done at the platoons, because only a small part of the whole traffic could be covered by one platoon. The central evaluation of

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of VHF traffic, intercepted by the different platoons, by the battalions brought about a certain loss of time, and did not allow the desired contact between intercept and evaluation personnel, but proved to be the only possible solution, as long as signal communication was satisfactory.

Insight into the distribution of VHF frequencies was greatly facilitated by the fact that the RAF, after changing to VHF, retained the call-signs it had used on HF.

The evaluation of VHF traffic followed the line established for the analysis of HF R/T. The enemy used radio transmitters 1133, 1143, and later 5043. These transmitters had four frequency channels (A, B, C and D buttons). The aim of VHF evaluation was to determine which of the four frequencies was being used by a unit. The results were as follows:

Each tactical unit (British wing, American group) had, on the A-channel its own frequency; thus the number of A-channels intercepted on a mission indicated the number of wings or groups in operation.

The three other channels were collective frequencies. A group of IX TAC had for example the following frequencies:

- Channel A = group frequency;
- Channel B = frequency of IX TAC;
- Channel C = frequency of 9th AF;
- Channel D = alternate frequency of IX TAC.

When this group was assigned to XIX TAC, the frequency channels were allotted as follows:

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Channel A = Group frequency (unchanged);
 Channel B = frequency of XIX TAC;
 Channel C = frequency of the 9th AF;
 Channel D = alternate frequency of XIX TAC.

If, therefore, the call-sign of a group appeared on a different common frequency than ordinarily, a change in assignment was assumed. This could usually be recognized more quickly from R/T traffic than from W/T point-to-point traffic, since the new R/T frequencies were often used during the first operation of the group under the new TAC, while the W/T call-sign might not appear for a number of days in the W/T network of the new TAC.

If, for example, groups transferred from 8th to 9th USAAF (as during the German Ardennes offensive of December 1944), they changed from the "C" frequency of 8th USAAF to the "C" frequency of 9th USAAF.

Frequencies of American units were changed mostly for tactical reasons, as described above. They were also changed, on rare occasions, for purely technical reasons (proximity of frequencies, interference, etc.). Changes of frequency in order to deceive German signal intelligence have never been noted.

In contrast, the British 2nd TAF changed its frequencies very often with the distinct intention of confusing German signal intelligence. However, it was always possible to recognize the tactical assignment of units by the individual group frequencies.

Specific rules for use of frequencies was not established, but generally the following principles prevailed:

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A-channel: Take-off and landing traffic; tactical traffic of the group or wing.

B-channel: Used merely as an Air Sea rescue frequency, or alternate tactical channel.

C-channel: Used for traffic between bombers and their escort; also by large fighter formations.

D-channel: D/P frequency.

Quite a number of units used their channels and call-signs differently. Night fighters for example, had two, and sometimes three transmitters at their disposal (8-12 channels).

3. Connection between Call-Sign and Frequency Identification.

Frequencies on which only three or four call-signs appeared were sure to be A-channels. The call-signs on this frequency therefore belonged to one wing (American group). The task then was to find the other frequencies on which the same call-signs appeared, so that the tactical assignment of this wing could be determined. Of valuable assistance were the frequent references to changes in channels. When such channel-changes were announced, the appropriate frequency was immediately monitored, and if traffic on the expected frequency did not appear, intensive searching began, as a change in tactical assignment was certain.

The work of the German signal intelligence service could have been made more difficult by frequent and simultaneous changes in frequencies and call-signs.

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This was never done by American organizations. Changes in call-signs, without simultaneous changes of frequency, made no sense and were very often detrimental. The first groups for example, which moved to the continent after the invasion changed their call-signs on the day they moved. After this system had been recognized, all groups that had moved to the continent could be immediately reported to our Command, solely on the basis of the changed call-signs.

In the same manner changing frequency without changing call-signs was more harmful than useful. During the activation of the RAF 84 Fighter Group from units of 11 Fighter Group, the squadrons which were transferred into TAF (84 Group) adopted TAF frequencies without changing their call-signs. Owing to this, it could be currently reported, which squadrons had transferred from 11 to 84 Group.

The only organization, which caused any real difficulty in determining its frequency channels was the IX Bomber Command. Owing to the fact that this Command constantly changed its operational call-signs, the setting-up of a card index system for call-signs was not possible. In the beginning it was almost impossible to determine which one of the frequencies was the A-, B-, C- or D-channel. By examination of radio equipment from crashed Marauders it could be recognized, that all three wings of IX Bomber Command had the same B-, C- and D-channels frequency. Determination of strength was therefore always possible by counting the remaining frequencies, as there had to be A-channel frequencies. However, it was impossible to determine the chain of command of units within the IX Bomber Command from E/T monitoring.

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The system used by the IX Bomber Command is therefore considered to be the most secure. Certainly the continuous change of call-signs from one operation to the next can hardly be expected on the part of fighter pilots. Even on the rare occasions of call-sign changes, fighter pilots would make errors which nullified the effect of these changes.

D. Royal Air Force (RAF). (See Figure 1)

1. Top-Organization.

After the RAF command nets had been reconstructed for the first time in 1940-41, they were only covered from time to time, in order to determine changes. Such changes could be determined very quickly, more so because British radio and press reported them rather openly.

The following noteworthy changes are remembered:

- a) Setting-up of Army Cooperation Command in 1940-41; its dissolution in 1943;
- b) Changes within the Training Command;
- c) Activation of 2nd Tactical Air Force; incorporation of 83, 84 and 85 Fighter Groups and 2 Bomber Group; deactivation of 13 Fighter Group;
- d) Dissolution of 7 Bomber Group; activation of 91, 92, and 93 OTU Bomber Groups; activation of 8 and 100 Groups.

The British cryptographic system used in the command nets could not be solved.

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Royal Air Force

Organization and Strength

(Front-Units only, excluding 2nd TAF)

— As of March 1945 —

HQ.
Bomber Command

1 Bo. Group

3 Bo. Group

4 Bo. Group

5 Bo. Group

6 Bo. Group

8 Bo. Group

Remarks

Co-operating with
Pathfinders of the
8 Group

Day-raids
G.H. - Navig.

Co-operating with
Pathfinders of the
8 Group

Own Pathfinders

Co-operating with
Pathfinders of the
8 Group

Pathfinder
Mosquito

Equipped with

Lancaster - Halifax - Stirling

Lancaster
Mosquito

Strength

About 75 Bomber Squadrons and 20 Conversional Units

About 15
Mosquito
and 6 St
4-eng. Bom

About 2300 a/c (1900 + 400)

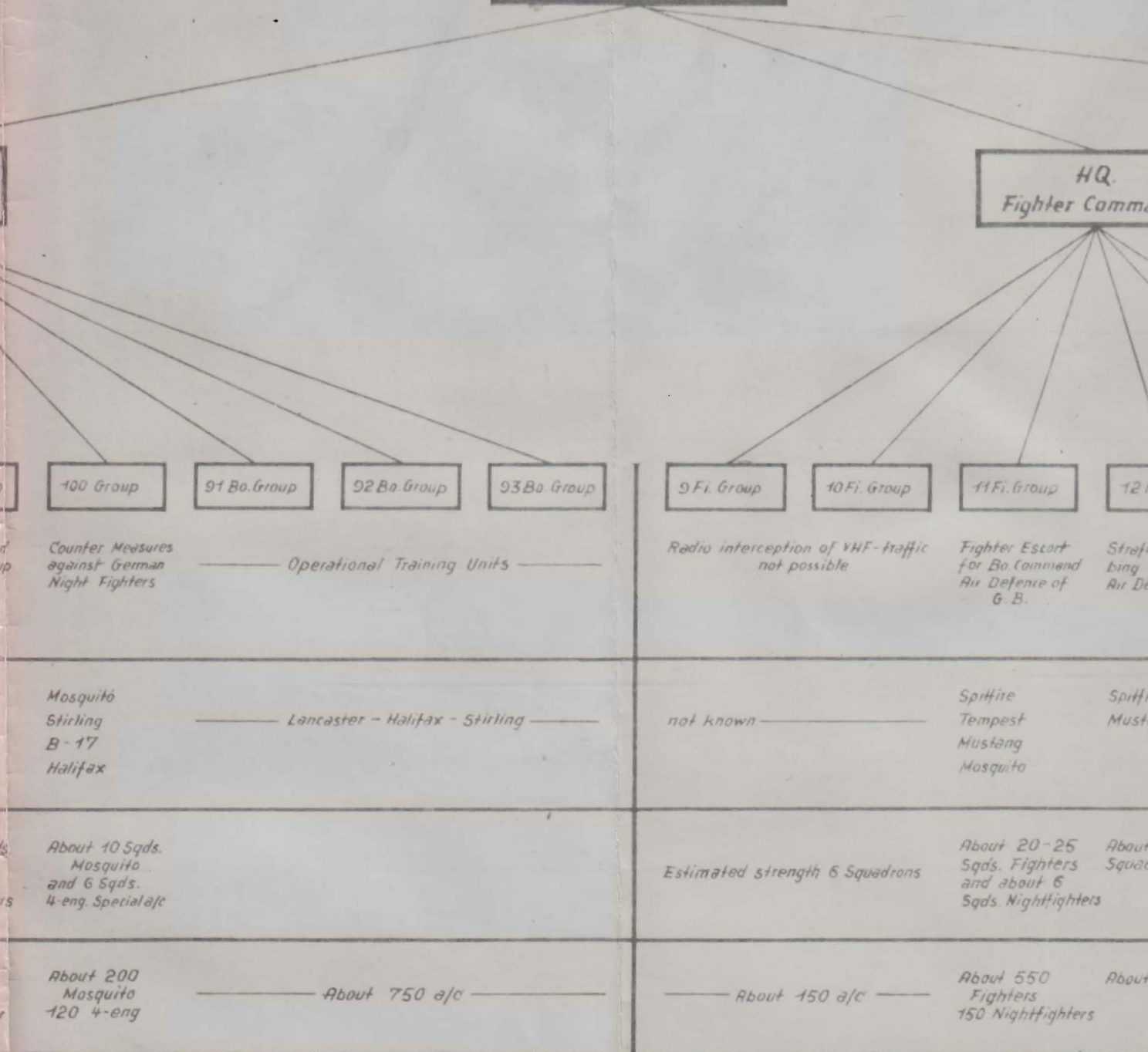
About 300
Mosquito
150 Lanca

Total Bomber Command:

1500 Bombers (First Line)
400 Bombers (Conversional Units)
300 Bombers (Mosquito)
150 Pathfinder (Lancaster)
200 Nightfighters (Mosquito)
120 Special a/c (4-eng.)
750 OTU a/c

Air Ministry

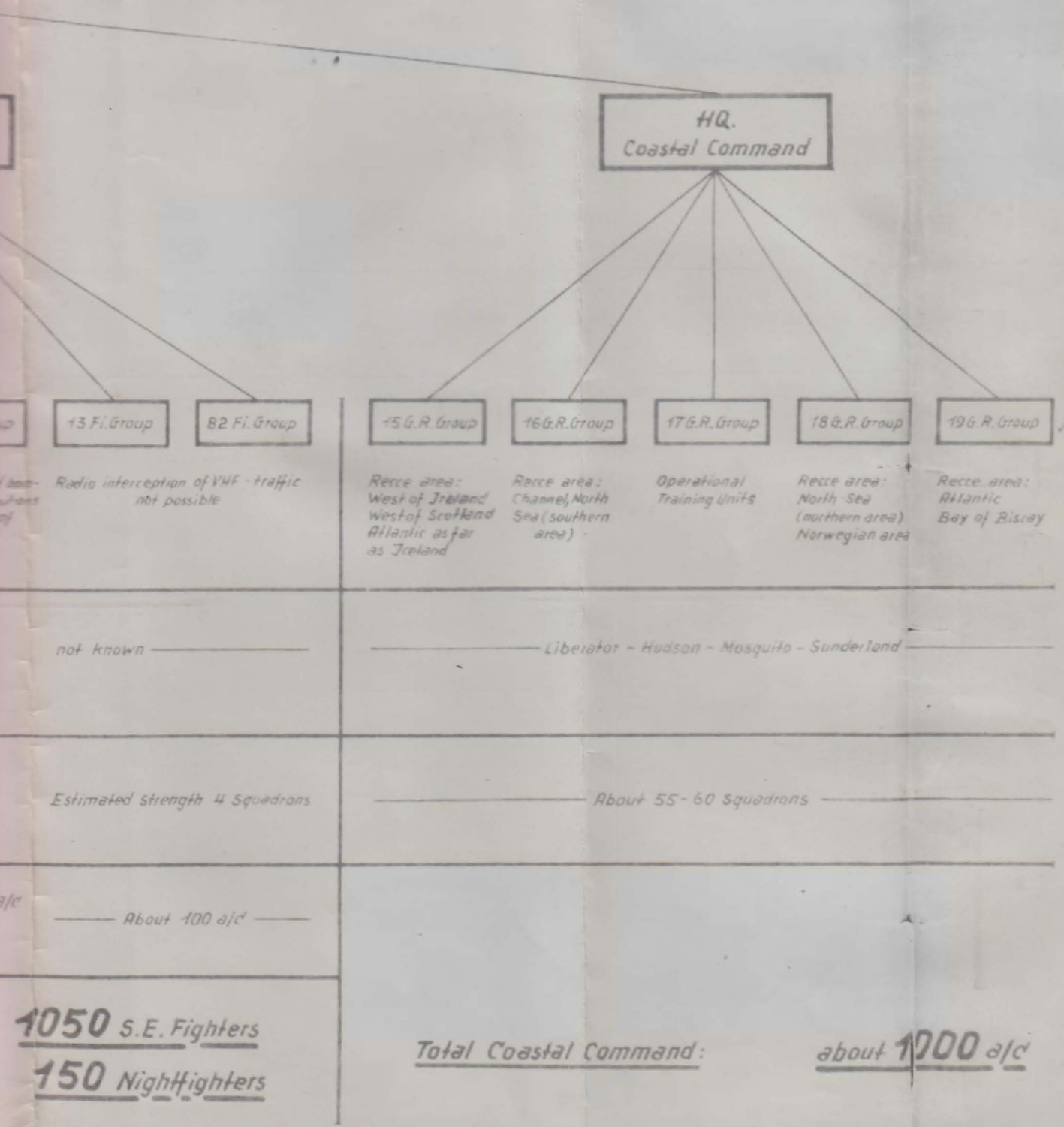
HQ. Fighter Command



about 3820 a/c

Total Fighter Command:

ab



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Bomber Commanda) General

The development of radio communication within Bomber Command showed more clearly than with any other RAF organization the intention to impede German signal intelligence through improved radio discipline, camouflaged procedure and radio silence. At the same time the monitoring methods of the German SIS also improved, so that the knowledge of the specialists became continually more comprehensive and intrinsic. The Signal Intelligence Service was greatly aided by the results of radar intercept.

As the RAF Bomber Command employed more aircraft, its losses increased correspondingly, and a greater amount of material was captured by the Germans. After large-scale attacks the complete SOI (signal operating instructions) and documents from an average of 3 to 5 downed aircraft fell into our hands. Through the well-organized service for salvaging enemy documents and equipment, and through the liaison section at Dulag-Oberursel (PW enclosure), the captured material was quickly turned over to SIS and evaluated. For solving strategic, as well as tactical problems, SIS had the following types of radio traffic at its disposal:

- aa) HF W/T traffic (point-to-point, airfield D/F sections, radio beacons);
MF W/T traffic (D/F sections, radio beacons).
- bb) HF R/T traffic (homing);
VHF R/T traffic (air-to-ground).

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cc) VHF and centimeter radar transmissions ("Magic Box", "G", "GH", "Weapon", "Monica", "IFF", "J-Beams", and ground radars).

In the use of call-signs, no distinction could be made between those of ground stations and those of aircraft. Ground stations rarely changed their call-signs, whereas aircraft changed approximately semi-annually. The separation of aircraft call-signs into "operational" and "station" (training flights, etc.) call-signs greatly facilitated clarification of the signal intelligence picture. Operational call-signs were used exclusively for flights into enemy (German) territory, from take-off to landing, while station call-signs were employed for all training flights, and ferry flights from the factories. Operational call-signs were changed with each mission, no definite system of change could be determined, but they were selected from a special call-sign list. A certain list of station call-signs was allotted to an airfield sector ("clutch"). The signal officer of an airfield allocated call-signs from this list, which were changed at irregular intervals, to all those squadrons belonging to the airfield sector. Permanent squadron call-signs were abandoned around the end of 1943, completely veiling the movements of squadrons, from the signal intelligence point of view. Nevertheless, a card index of all identified call-signs since the introduction of station calls, made it possible, in the beginning of 1945, to reconstruct the fixed call-sign lists of each airfield sector, and thereby the call-sign of each airfield radio station. Hence it was possible to diagnose immediately any change in call-signs.

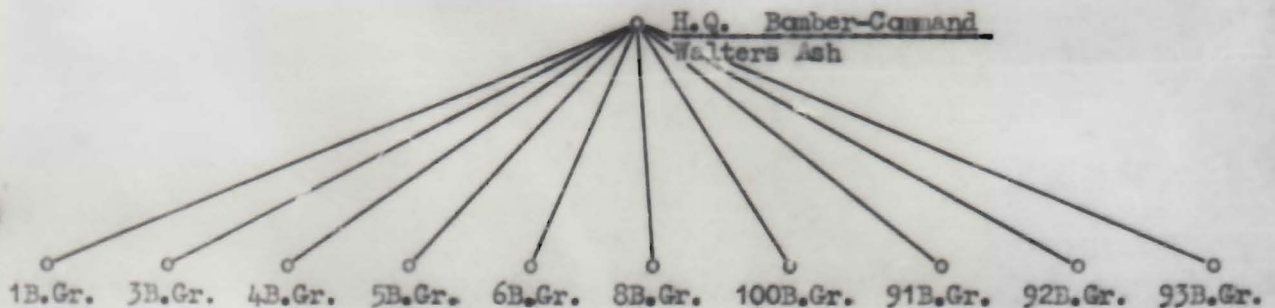
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b) Organization

The foundation of all SIS intelligence on the organization of Bomber Command was the point-to-point networks. The air-to-ground traffic of tactical groups, which groups were currently identified from captured documents, was monitored in order to supplement the interception of the point-to-point networks. Since 8 and 100 Groups did not appear in the point-to-point networks, their subordination to Bomber Command could not be determined for a rather long time. In this case only captured documents brought complete clarification. Even before these documents were captured, however, the existence of two new groups had been indicated by the appearance of two new control stations in air-to-ground traffic.

The organization of Bomber Command in March 1945, as obtained from SIS sources, was approximately as follows:



The organization of the individual groups was reconstructed primarily from the point-to-point networks, and from knowing how each group was employed operationally. Transfers of airfields from one group to another, when indicated from the monitoring of the command networks of the groups, were usually confirmed by the

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air-to-ground traffic from the airfield in question, since the aircraft occupying this field would then receive operational instructions from the control station of the new group.

c) Strength

In March 1945 the total of all active combat squadrons of the RAF Bomber Command was estimated at 65-70 squadrons. Maximum strength in operational aircraft was assumed to be approximately 1700 four-engined, and 200 twin-engined. The actual strength on any one mission was naturally smaller. The following was the estimated strength of individual units:

1 Bomber Group	-	250 Lancasters
3 Bomber Group	-	250 Lancasters
4 Bomber Group	-	250 Halifaxes
5 Bomber Group	-	300 Lancasters and 60 Mosquitos
6 Bomber Group	-	200 Lancasters and 100 Halifaxes
8 Bomber Group	-	150 Lancasters and 150 Mosquitos

N.B. The above figures represent the average operational strength maintained by the individual groups during the last six months of the war.

A retraining unit ("Conversion Unit") was assigned to each operational group. These conversion units had their own airfields, and retrained previously-experienced pilots onto the aircraft type flown by the group. Pilots with no operational experience came from the three OTU (Operational Training Unit) Groups. The over all strength

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of the OTU groups and conversion units was approximately 1500 aircraft (twin-engined and four-engined). In contrast to the German Luftwaffe, the RAF Bomber Command had been developed during the war, following its experiences in the Battle of Britain. In essential outline, it had already assumed its present-day form in the beginning of 1943.

There was essentially no specialization among the groups as to types of missions flown. For example, small-scale mine-laying operations were flown by squadrons from Hemswell (1 Bomber Group), Pocklington (4 Bomber Group), and Mildenhall (3 Bomber Group). In larger-scale operations of this nature, however, (the Baltic, and the Channel coast) every group was represented. With the passing of time, certain Bomber Command units developed specialities. There follows an approximate accounting of their tactical employment, as of March 1, 1945:

aa) The main body of the formations consisted of Lancasters of 1 and 6 Groups, and Halifaxes of 4 and 6 Groups. These units flew their missions exclusively under the direction of Pathfinders of 8 Bomber Group.

bb) Special Units:

3 Bomber Group.

This was a Lancaster group which, in the latter years, flew its daily missions under special navigational control ("GH"). The normal strength of such ground-controlled attacks came to 150 aircraft. This group, which was also the oldest group of the Bomber Command, had two Halifax squadrons for special

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operations (sabotage, agent-dropping, supply-dropping to partisans) stationed on Tempsford airfield. These squadrons collaborated closely with 38 Wing of 2nd TAF.

5 Bomber Group.

This was a Lancaster unit, with one squadron of Mosquitos as Pathfinders, and was considered the best organized unit of the Bomber Command. It renounced technical navigational aids, such as "Bocmerang" and "GH", in favor of individual dead-reckoning navigation by each aircraft, in which procedure the group attained the highest degree of perfection. The group always flew alone with its own Pathfinders. It was led by a "Master of Ceremonies", who was fully responsible for the smooth conduct of operations over the target. A special squadron of this group was the noted 617 Squadron (Coningsby) which carried out low-level attacks on special targets, such as dams, factories, viaducts, and ships. It was the first squadron to drop 10-ton bombs (March 1945). The well-trained crews of this group observed the best possible radio discipline, and therefore it was very difficult for the Signal Intelligence Service to plot or identify this unit during operations.

8 Bomber Group

This unit was the so-called "Pathfinder Force". Toward the end of 1944, the best and most experienced Bomber Command crews were assembled in this group to create a Pathfinder unit, modeled after the German target illuminators. According to their ability, crews were trained as "masters of ceremonies",

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"original target markers", and "relief target markers". In addition to this Pathfinder unit, Mosquito squadrons were set up (at first in Markham), which were used as long-range bombers, and, after the development of "Boomerang" procedure, as precision bombers.

100 Bomber Support Group

This was viewed as the most interesting group from the standpoint of signal intelligence. It had been created because of the knowledge that the German Command had been able to obtain very early a clear picture of the air situation, and the German night fighter organization was threatening to become a menace. The group had a twofold task: the camouflaging of RAF offensive intentions through radio deception and jamming, and the active combating of German night fighters. For this reason the group was equipped with both twin-engined and four-engined aircraft. The four-engined squadrons (Stirlings, Halifaxes, B-17's) were used as jamming aircraft, and had special equipment. They jammed mainly Wuerzburgs, Freyas, and German night fighter traffic, both HF and VHF. They were also able, by virtue of special equipment, to create an erroneous impression of the size of their formation.

During an intruder mission, 100 Group had command not only of its own twin-engined squadrons, but also of all squadrons of other groups which were used for combating the German night-fighter defense.

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d) Operations

In December 1939, a rather large RAF Wellington unit attempted an attack on Northern Germany for the first time. It was recognized during its approach flight by radio traffic (QRM, D/F-ing, etc.). The German fighter defense was informed in time and could be vectored onto the enemy, so that the raid ended with high losses for the RAF.

After this success by the SIS, the intercept units were greatly reinforced and improved. Up to this point the possibilities of SIS were considered to be limited to determining organization and strength, but now special emphasis was given to immediate tactical evaluation. Later the direct support of the Reich's Defense by the SIS became its main task, the purpose of which was to present a continuous picture of the air situation. This was accomplished by evolving a highly developed and sensitive reporting net which reached its apex in the operations of the Meldekoepfe and the ZAF (Reference is made to the special study of the operations of Meldekopf 1 in Vol. VIII).

Besides the immediate evaluation of all tactical messages intercepted during a raid, and reported by the Meldekopf to the operational staffs, there was promptly, after the end of a raid, a reconstruction of all its phases and details, which were incorporated into a report on the air situation. Out of this general picture was drawn all conclusions applying to both the tactical and strategic situation. The report, which was distributed by teletype to the evaluation companies and the Chi-Stelle, invariably contained the following points:

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- Duration of the raid;
- Routes followed;
- Total strength (given in detail by groups);
- Peculiarities (targets, SOS calls, damages and casualties);
- Conclusions (general estimate of the raid and important observations).

These reports were made twice daily, one for the RAF night raids, the other for the 3th Air Force day raids. In case Germany was raided several times a day, a report was prepared and distributed covering each raid separately. The data entering into these reports were gathered as follows:

- aa) The duration of the raid comprised the time from the first take-offs, or radar interception, until the last raiding aircraft was landed, i.e. the time that the last landing-weather-report was heard;
- bb) Routes followed by raiding formations were tracked by bearings taken on HF, VHF and radar, by the different out-stations of the Meldekopf, and graphically presented in its operations room;
- cc) Strength: Each airfield D/F section gave its returning squadrons reports of weather over base. By the number of call-signs transmitted, it was possible to determine the number of squadrons on a field. The mission strength per squadron was estimated to be fifteen to eighteen aircraft. In addition to this obligatory traffic of the airfield D/F sections, came the traffic between the raiding aircraft and their group headquarters concerning winds aloft, bombing reports, and evasive action. Determination of the different night raids was made pos-

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sible by comparison and close observation of the different times at which interchange of traffic occurred;

- dd) Emergency and damage reports never offered anything of importance to evaluation because the percentage of aircraft that were forced to break off the mission before reaching the target never exceeded three percent for any one mission;
- ee) Conclusions on the nature of the attack could be drawn from the quality of the radio discipline, the interchange of messages, behavior of the bombers over target, reports on bombing effects, by the R/T traffic of the "masters of ceremonies", and by the landing traffic (instructions to land on alternate airfields, etc.).

Besides the purely four-engined bomber raids, in which certain group combinations were favored, raids by Mosquito aircraft grew ever larger. These attacks were never entirely solved with respect to strength and composition of aircraft. The only calls employed during these raids were "CQ" call-ups by group headquarters reporting weather over base. In only very rare cases was VHF R/T traffic between Mosquitos heard. The tracking of these very fast bombers, however, was always guaranteed by interception of their airborne radar. In the final days there was an increase in cases where the plotting of R/T traffic without tactical significance proved an additional means of tracking.

A mission of the 100 Bomber Support Group was easily followed by SIS. The special operational tactics of the group, namely, the

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Jamming of certain pre-determined areas, made it necessary for aircraft of the group whose jammers became unserviceable during the approach flight, to break radio silence, and to report the fact to group headquarters. Each aircraft was assigned a jamming area in which it had to remain for a specified length of time. Changes of jamming areas, or their boundaries, presented no difficulties since the VHF jammers could be D/F'ed.

The use of the 100 Bomber Group for jamming and deception flights could be determined by certain characteristics in the advance preparations by the other bomber groups. If during the day no other group prepared itself for a mission, then a "spoof raid" by 100 Group during the night could be anticipated.

The various types of Pathfinder and target-marking techniques of the 5 and 8 Bomber Groups could not be determined from the radio traffic. The traffic of 8 Bomber Group was negligible because more and more it adopted the use of navigational aids for bringing its pathfinders over the target. Only when over the target was brief R/T traffic from the "master of ceremonies" intercepted. On the other hand the tactical radio traffic of the "master of ceremonies" of 5 Bomber Group proved far more voluminous. Approaching the target the "master of ceremonies", and his controllers, used also the tactical frequency of the group to communicate in W/T between themselves. Corrections in target-marking, instructions as to how, and on which flares the bombers were to release their bombs, as well as instructions for leading the bomber stream over the target, took place on both W/T and R/T. It was evident, in the case of the W/T

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traffic, that the three-letter code was usually inadequate; so as a rule clear text had to be used also.

Obligatory bombing reports were transmitted by the "masters of ceremonies" of the 3, 5 and 8 Groups, which were the only groups operating independently.

The transfer of squadrons within an airfield sector could be determined from a study comparing the radio traffic of operational squadrons with that of the daily training traffic from the same airfield. But as a great quantity of captured documents fell into German hands throwing light upon this subject, the General Staff did not need to rely upon the SIS entirely in the matter.

e) Air activity over Great Britain

The monitoring of bomber activity over Great Britain brought the following results:

aa) The number of aircraft on an individual airfield, following its occupation by new units, was immediately recognized.

Evacuation of squadrons on the other hand, could often not be recognized at all, or only very late. This is explained by the fact that if radio traffic were not heard, evacuation could not immediately be assumed, as other factors, such as difficulties of interception, radio silence, change of frequency, inactivity of a squadron, etc., might be the reason.

As units stationed at the same airfield all used the call-sign of that field, and as these call-signs never changed, we

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were able to prepare a simple chart, such as that shown below, which was sufficient to give a clear picture of the number of aircraft occupying the field.

- bb) Insight into the training operations, strength, and efficiency of the OTU's: 91, 92, and 93 Groups were covered daily until the beginning of 1944 and from then on only every third day.
- cc) Transfers before missions, return flights of aircraft which landed at alternate airfields because of weather, etc., recognized.
- dd) The connection between individual units and airfields was established. For example, it was noticed that aircraft of 38 Group often flew from Netheravon to Tempsford. A connection between 38 Group and the squadrons at Tempsford which supplied agents was suspected, and later confirmed.

3. Fighter Command (See Figure 2)

a) Organization.

At the start of war and until the activation of the Tactical Air Force in 1943, the Fighter Command was organized as follows:

HQ in Uxbridge

9 Fighter Group Western England

10 " " Southwest England

11 " " Southeast England

12 " " Eastern England

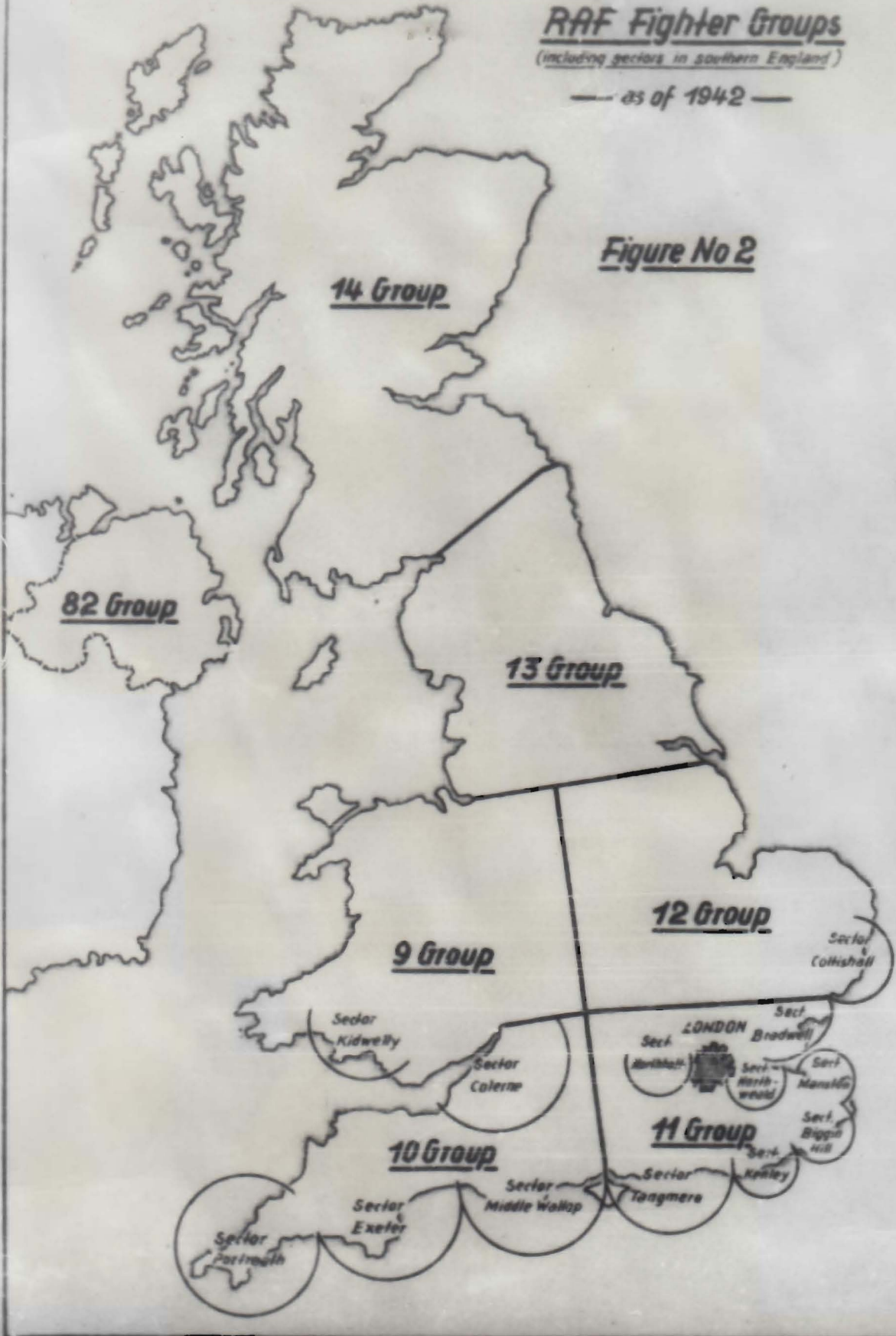
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RAF Fighter Groups

(including sectors in southern England)

— as of 1942 —

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- 13 Fighter Group Northern England
- 14 " " Scotland
- 82 " " Northern Ireland

Basis for estimates again were the point-to-point networks. When TAF was activated in May 1943, the following changes took place:

- aa) Dissolution of 13 Group;
- bb) Activation of 83 and 84 Groups within TAF, from squadrons of Fighter Command;
- cc) Changes within 10 and 11 Groups such as the assignment of sector Middle Wallop to 11 Group.

b) Operations

From the lively R/T traffic of British fighter units, a clear picture of the tactics of Fighter Command could always be gained. RAF Fighter Command was at first purely defensive. Its greatest triumphs were achieved in 1940 during the Battle of Britain. During this defensive action the following principles of fighter control were evolved:

aa) Day Fighters

The aircraft took off in airfield sections at the same time communicating the take off with the D/F section. Immediately after taking off, the fighters called the sector control station. The sector control station assigned them certain routes for patrolling or waiting areas, in which they had to cruise at a given altitude. While patrolling, the sector control

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station gave the fighters a verbal report on the current situation. If German aircraft entered the sector, the fighters were vectored toward the enemy aircraft. In special cases, such as in foggy weather, the sector control station instructed the fighters to report to a given fighter control station. This station then took over direction, and, with the help of radar, guided the fighters as near as possible to the German aircraft. The fighters relied to a great extent on the ground station. Not only did they depend on the ground station in order to find the German aircraft, but even the order to attack came from the ground. Messages such as the following were frequently heard:

"Why did you attack without permission? If something happens to you, it is your own fault."

The ground stations insisted that fighters attack only from favorable positions either from above, or from out of the sun. When the fighters made contact with the enemy, they reported success or failure to the sector controller, who then gave them permission to land. Fighters then called the airfield D/F section and received homing instructions.

bb) Night Fighters.

The system for controlling night fighters was developed very early, was improved and refined in many ways, and remained in effect until the end of the war.

Night Fighter Activity on Clear Nights.

This activity was carried out either on moonlight nights, or with the aid of searchlights. The night fighters took off with assistance from the airfield D/F section, and then

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reported to the sector control, which guided the fighters on approximate courses until they could see the enemy aircraft. From then on, the night fighters operated independently. Control was therefore not strict.

Night fighting on Dark Nights.

The night fighters took off and then reported to the sector controller, who assigned them certain illuminated areas to patrol. In case of a German raid, the sector controller instructed a night fighter to report to a fighter control station. The fighter control station informed the night fighter very exactly as to course (several reports in one minute), and guided him to within 2-3 km of a German aircraft. Then the fighter controller ordered the night fighter to switch on his "Weapon" (Airborne radar) and the latter tried to find the enemy aircraft with this apparatus, and operated independently from there on.

In addition to patrol activity, the Squadrons of Fighter Command were mainly used as escorts. Even the first-line combat units currently carried out intensive training operations (tactics in formation flying, dog-fighting, etc.).

With the decrease of German bomber activity, and the growing strength of the RAF, the Fighter Command went over more and more to the offensive. The longer the range of their missions, the more difficult became strict control from the ground. Therefore several squadrons were combined into a wing under a wing commander. The

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wing commander took over a great part of the tasks that were handled previously by the ground stations. Except in cases of emergency, he only maintained R/T contact with the sector controller. He received air situation orientations and commanded his formation accordingly. The success of wings depended largely on the personality of the wing commander (the most outstanding were the Polish Wing Commanders "King-Kong" and "Oxo" from Northolt, and "Hugo" from Northweald). Wings usually consisted of squadrons of the same nationality. The different nationalities, when speaking English, were recognized by their accents, as were the American volunteers of the "Eagle Squadron" before the USAAF came to England.

In the course of the war, the Fighter Command wing took over fighter protection for heavy bomber formations. After activation of 83 and 84 TAF Groups, Fighter Command changed its name to "Air Defense" Britain. Lack of German operations against England caused this "Air Defense" to retain its offensive flavor.

After the British heavy bomber units began daylight attacks in the summer of 1944, squadrons of the Air Defense were used as fighter protection for these units. The British four-engine units retained, even by day, the bomber stream system, in contrast to the close formation flying of the American 8th AF. Therefore, the fighter cover did not fly in close formation, close to the bombers, as did the Americans, but protected it while being spread out over a wide area. From a technical signal standpoint it was surprising that until the very last phase of the war no common R/T frequency

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existed, for both the bombers and their fighter cover, although the bomber units had VHF R/T equipment.

Radio communication between bombers and their escort could therefore, if necessary, only be achieved through the medium of a ground control. During the last weeks of the war, traffic between "Bomber-Leader" and "Escort-Leader" was intercepted in a few cases.

British fighter units also provided fighter cover for units of Coastal Command during its missions against Norway.

Near the end of 1944 the "Air Defense" again changed its name to "Fighter Command" owing to a lack of defensive activity. During the period of German V-1 attacks during the summer of 1944, several squadrons of 11 Fighter Group were used for defense against flying bombs. Fighters tried to attack the bombs from above, in order to counteract their great velocity. There were frequent references in R/T traffic to attempts to destroy flying bombs, a usual comment being that they were "too fast". Frequent mention was also made of the danger in combating the flying bombs. Close collaboration of fighters with flak and with balloon barrages was indicated. The SIS was at that time the only reliable source of intelligence to the High Command regarding the defense against this new weapon.

Since the V-2 rockets could not be combated in the air, units of 12 Fighter Group attacked launching sites in Holland. Results of these missions could not be determined from R/T traffic.

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Operational radio traffic of Coastal Command was enciphered with X- or Q-groups, the Air Force Code (Naval Section) and Syko. Since all these cryptographic devices had been captured, Coastal Command traffic could be read almost like clear text until 1944.

c) Operations.

The coverage of air-to-ground traffic, especially that involving headquarters radio stations, brought continuous intelligence as to where submarine reconnaissance efforts were being concentrated. 15, 16, 18 and 19 Groups were covered continuously. Some frequencies (for example, those of 15 and 16 Groups) were covered both in the West and in Norway, because of bad communications.

b) Organization.

Even since 1943 Coastal Command had minimized the amount of traffic in its point-to-point networks, and in some cases had eliminated it entirely. This made it almost impossible to determine changes in organization. The transfer of Kew into units of 16 and 19 Groups to Scotland, for example to assist 18 Group, was known only from R/T.

a) General.

4. Coastal Command.

Fewer captured documents and prisoners of war were obtained from Coastal Command than from any other combat organization. For the entire duration of the war SIS proved to be the only source of intelligence from which the activity of Coastal Command could be appreciated.

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Later a three-letter code was introduced in place of Syko, causing an interruption in the deciphering. This system was broken early in 1945.

The coverage of Coastal Command traffic yielded the following possibilities for immediate evaluation:

- aa) Locations of convoys were learned from traffic between the control ship and reconnaissance aircraft. This information was of vital importance to the U-Boat Command;
- bb) Convoy routes were often determined;
- cc) German submarines could be warned when they had been spotted by reconnaissance aircraft;
- dd) German blockade runners, convoys and naval units reported by Coastal Command, were warned; German fighters alerted in case of imminent attack.

The two squadrons based on Thorney Island and Manston played a special role within Coastal Command. They were used only at night against German shipping in the Channel, and were vectored onto ships by VHF R/T traffic from the ground. From here on they could operate independently with the help of their ASV equipment. This R/T traffic enabled the German SIS to warn the ships. It proved advantageous to assign to the ships, Luftwaffe SIS teams with HF and VHF receivers. Intercept platoons on shore transmitted warning messages which were received by the HF set on board ship. After the intercept station on shore had picked up the frequency on which Coastal Command aircraft were being guided to the convoy, it

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transmitted this frequency to the VHF interceptor on board ship, who then intercepted the traffic directly. The commander was continuously informed of the air situation and could take necessary countermeasures in time. The Navy held these Luftwaffe intercept teams in high esteem, and was always very grateful for their assistance.

d) Occupation of Airfields, Strength and Equipment.

Occupation of individual airfields could be clearly determined from landing traffic and ETA messages. A radical change in call-signs took place in 1945, when the individual aircraft marking was changed from a letter to a figure. Also fixed station call-signs were omitted. This made the determining of details more difficult. The solution of these call-sign problems was handled by Sgt. Ptook in Referat B of the Chi-Stelle.

The total strength of Coastal Command, as calculated by signal intelligence was approximately 1100 aircraft including those based in the Azores, Newfoundland and Iceland, and also the American squadrons stationed there.

5. Army Cooperation Command.

a) General.

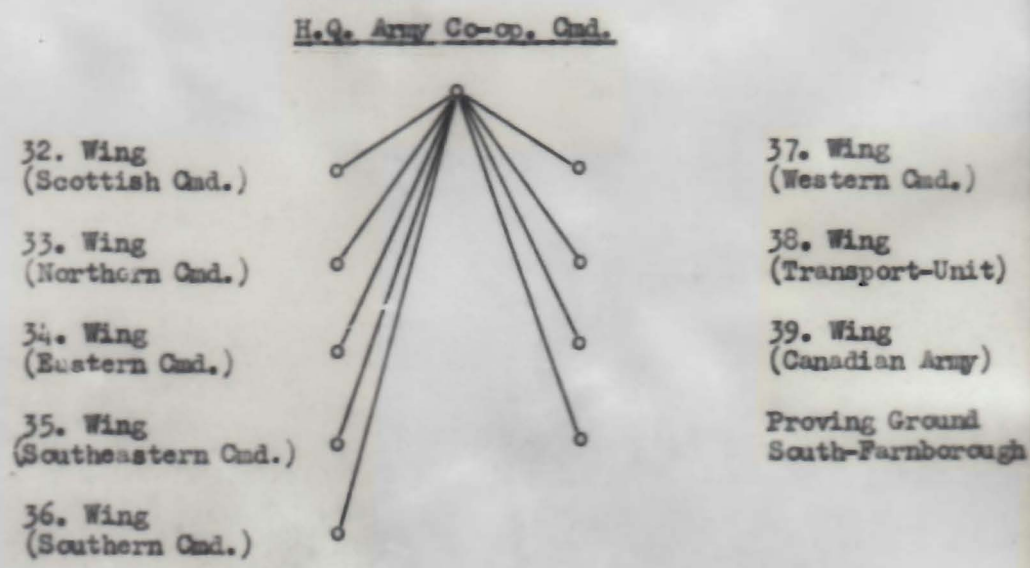
When the Army Cooperation Command was activated following the French Campaign in 1940, it was often mentioned by the British press and radio, that this command supplied special fighter, bomber, and transport units for army support.

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The German High Command assumed that such units would be earmarked for the ACC, and would remain in reserve until the time of a large-scale landing operation. However, radio traffic of such units were not heard. By listening solely to the point-to-point networks of the ACC the following organization was reconstructed:

b) Organization.



The tactical reconnaissance (recco wings 32, 37 and 39) worked closely with the army units in whose area they were stationed.

38 Wing was later identified as the transport wing. Units under the Proving-Ground at South Farnborough were of no tactical importance. Lysanders were used for tactical reconnaissance. The combat value of the Army Cooperation Command was assumed to be very small as no fighters or bombers could be identified.

Beginning with the spring of 1942, a very intensive coverage of all manoeuvres and preparations for invasion of the British

Army and RAF was maintained, in order to answer the question, as to which RAF units would be used to support the British Army during an invasion.

c) Manoeuvres in Great Britain Until the Landing at Dieppe.

From the Army SIS it was learned that training in Great Britain was intensive. During these manoeuvres close cooperation was practiced by the RAF and the Army. An average of about 100 small and large-scale manoeuvres per month were observed during this period by the SIS of the German Army and Luftwaffe. Close collaboration and exchange of liaison officers assured thorough evaluation of this material.

The great amount of R/T intelligence at that time made it not only possible to follow the evolution of British tactics, but also to determine which RAF units were intended for army support. In addition numerous abbreviations, cover-names etc. were identified. Especially good results were obtained from the coverage of the following manoeuvres, held in the spring of 1942:

- Manoeuvre "Tiger" in an area southeast of London;
- Manoeuvres "Lumber" in the Wash;
- Manoeuvre "Dryshot" in Dumfries shortly before the Dieppe landing.

Important intelligence gained from this coverage was:

aa) Special Fighter and Bomber units of the ACC did not exist.

The squadrons which participated in the manoeuvres belonged either to the Bomber or the Fighter Command. Very frequently 88 and 226 Squadrons of 2 Bomber Group appeared. Therefore it was assumed, that 2 Bomber Group would be taken away from Bomber Command in the event of an invasion, and would be used for army support;

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- bb) The tactical reconnaissance squadrons changed from Lysanders to Mustangs. First information of this change came from 309 squadron, then from 400, and 414 squadrons, and in about May 1942, from other squadrons;
- cc) An exact knowledge of the British grid-system (modified system) was gained, which later was useful in compiling maps for France with the same grid;
- dd) Accurate information was obtained on the tactics of the AOC, such as the use of Tentacles, Air Support Links, setting up of Army Air Support Controls, and the form of certain types of encoded messages. The following is an example of a message calling for air support:

Message

A gun position Q 1145
B 12 bombers
C 0900 hours
D not north of the river
E hvy AA
F 0739 hours

Explanation

Location of target in grid
 Number of aircraft desired
 Time of attack
 Special instructions to avoid danger to own troops
 Anticipated flak defense
 Time of origin

- ee) An insight into the proficiency of units in training was obtained (umpire networks gave such information). Morale, strength, equipment, and also often the operational names of units were determined;
- ff) This monitoring also offered explanation of numerous abbreviations of the following kind

NMS	-	No movement seen
COL ALA	-	Columns all arms
AT	-	Anti-tank
ASP	-	As soon as possible

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Intelligence gained from manoeuvres in Great Britain was later of the greatest value in the Dieppe raid and the invasion.

In examining and processing many clear-text messages during the manoeuvres, the impression was created that the traffic was sent "en clair" because there was no thought of German monitoring of these manoeuvres.

d) Dieppe Raid, August 19, 1942.

The approach of the landing fleet took place under radio silence. Once the landing started, however, all messages were intercepted, as was proved by the message numbers. Due to the favorable locations of the intercept stations, the intelligence gained could be transmitted immediately to the ground forces and to the fighter defense. When the units which had landed made urgent requests for air support, there was still an interval of about 30 minutes between the time the request was granted and the aircraft arrived. During this interval the German fighter defense was informed, and took off in time to attack the approaching British formations out of the sun.

The High Command was of the opinion that the unqualified success of the defense against this raid was due, to a great extent, to the good work of SIS. Through carelessness, some information of the success of signal intelligence appeared in the press, and was even mentioned in a speech by Reichsmarschall Goering. After Dieppe, therefore, there was a tendency on the part of the British to tighten the security of their traffic, even during manoeuvres.

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- e) Combat Missions of the ACC from Dieppe Until the Activation of the TAF.

With the progressive change over to Mustang aircraft the squadrons of ACC were used more frequently for front-line missions. During the Dieppe raid several squadrons were used for tactical reconnaissance after failure as fighter cover for the returning Dieppe landing fleet. In the period following, individual missions of Mustangs, usually flying pairs, were carried out for purposes of photo reconnaissance and attacks on targets of opportunity, especially communications. Recognition of these raids was difficult for signal intelligence, as the pilots turned on their radios only during the return flight, when asking for homing instructions. Meanwhile a change from HF (radio set TR 19) to VHF (radio set 1133 or 1143) took place. In comparison with the sorties of the RAF Fighter Command, activity of the Army Cooperation Command was always negligible. ACC did not represent an effective and sufficient medium of support to the army during a large-scale landing operation. Only activation of the 2nd British Tactical Air Force in May 1943 brought about a decisive change in this respect.

- f) Identification of 38 Wing (later 38 Group).

For a rather longer time the significance of a subordinate network of the ACC, with its control station in Netheravon, was not determined. There were the following facts:

- aa) In late summer of 1942, during an army manoeuvre, 295 and 296 Squadrons were mentioned for the first time;

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- bb) About the same time a radio station was picked up on search and from its characteristics was recognized as a control station. This radio station was pin-pointed in Netheravon;
- cc) Aircraft were frequently in touch with this station and transmitted bomber code messages. Several of these messages were deciphered and information was thus obtained that glider towing was being practiced;
- dd) From a PW captured at Dieppe it was learned that British glider units had been activated near Netheravon;
- ee) During a later manoeuver 38 Wing was mentioned in clear text, together with 295 Squadron and glider troops.

On the basis of this material it could be definitely assumed that 38 Wing was a transport unit of AOC to be used for airborne troops. This was confirmed, when material regarding 38 Wing was captured during a Commando raid on Norway in November 1942. This unit was then covered more thoroughly and the following additional information was determined:

- aa) Airfields: Netheravon, the Hurn area, Thurleigh and several others;
- bb) Assigned to 38 Wing: 295, 296 and 297 Squadrons, equipped with Whitley aircraft;
- cc) One of these squadrons was transferred to North Africa, and later participated in the Sicilian Campaign;
- dd) The other squadrons performed training flights in 1943 and 1944, and also supplied the French resistance movement and dropped leaflets;

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- ee) They cooperated with agent-dropping units at Tempsford, and the operational training units of Bomber Command;
- ff) Shortly before the Invasion, 38 Wing was increased by adding units of Bomber Command, and became 38 Group.

g) Identification of Units assigned to South Farnborough.

Another unidentified radio station in the command net of AOC was D/F'ed in South Farnborough. This radio station appeared simultaneously as net-control station in two sub-networks. The sub-stations of these networks were all located on the coast, mainly in the West.

At first they were assumed to be either supply stations or Navy liaison stations, but captured documents brought clarification. These stations turned out to be "AA-Warning Ranges", over which warned aircraft were forbidden to fly. It was clear therefore, that there were flak schools or gunnery ranges. A logical assumption was that the intercepted radio traffic was connected with these schools, since flak in Great Britain belonged to the Army, and the AOC was responsible for collaborating with the Army. As the units in question were flying units, their mission could only be to tow targets. Later it was learned from captured documents, that "Anti Aircraft Cooperation Units" were being used for towing target sleeves.

Complete clarification of the other network was not possible. It was assumed that these networks served similar schools and experimental stations.

These networks were later dropped, since they had no tactical value.

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6. Tactical Air Force (TAF).

a) Activation in spring of 1943.

It has been seen that the Army Cooperation Command was not capable, either through its training or strength, to effectively support the army during the planned invasion. Either the ACC had to be reinforced with units of Fighter and Bomber Command, or had to be completely reorganized.

In March or April of 1943, a completely new radio organization with numerous networks appeared in southeastern England. That they were RAF units was clearly realized by their use of known delivery groups in preambles, and by other characteristics of radio procedure. The volume of traffic continually increased. Changes also took place within other networks, and therefore the expected reorganization of the RAF seemed to be in the making. This reorganization was confirmed, and the SIS problems caused by it, were dealt with as follows:

- aa) Whereas all RAF units had previously used call-signs of two letters and a figure, the new call signs consisted of a letter and two figures. It was known from Mediterranean traffic, that the 1st Tactical Air Force used the same type of call signs with inverted structure (e.g. two numbers plus a letter). This fact gave the first hint that a Tactical Air Force was to be activated in Great Britain also;
- bb) Several control stations of this new TAF appeared in the main point-to-point network of Fighter Command. Close communication between Fighter Command and TAF could be presumed

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as a result of experiences in Africa and Dieppe. In both cases most effective army support had been achieved by fighter units, and the fighter arm stationed in Great Britain was available for offensive missions because of the changed war situation;

- cc) The ACC lost more and more of its former importance and gave up several tactical reconnaissance wings to Fighter Command. Finally, only 38 Wing and several other units of 2 Bomber Group remained under the ACC;
- dd) The deactivation of 13 Fighter Group, and the occupation of its airfields by 12 and 14 Fighter Groups was learned by interception of the new point-to-point network of Fighter Command. At the same time the coverage of new radio networks and of VHF R/T traffic, revealed the activation of a special fighter group of TAF, 83 Group. Details of this group were soon learned from intercepted clear-text messages during Army manoeuvres. It was based in southeastern England, and consisted of squadrons which originally came from 10, 11 and 12 Groups and from the Army Cooperation Command;
- ee) In the middle of 1943 another subordinate organization of TAF was activated in the area of York, whose radio communications were very similar to those of 83 Group. At that time a large-scale manoeuvre with the Army was held in the area of York. It was assumed at first by the Germans, that this was a preparation for an invasion of Norway. However, after the manoeuvre D/F showed that the RAF-radio stations had moved into the area northwest of London. Their transmissions continued throughout this

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move. It was assumed that this was 13 Group in new form, and this assumption was strengthened by an announcement in the press, that the former chief of 13 Group had received an important special assignment. Much later it became known that this was 84 Group;

- ff) 2 Bomber Group was removed from Bomber Command and assigned to TAF;
- gg) Control stations of TAF were pin-pointed in the area of Stanmore and Fair Oaks, which was the former location of the ACC.

Later, press and radio reports, as well as captured documents referring to the activation of the 2nd Tactical Air Force, again confirmed information gained by signal intelligence. Statements of PW's were almost never fruitful at that time, because the PW's in most cases were unaware of any changes in organization. Owing to the importance of TAF, its traffic was covered in great detail, even at the expense of abandoning other tasks. A detailed knowledge of the radio stations, except for control stations and several radar stations, could not be obtained, since only unreadable cipher messages and contact procedure were heard. Nevertheless, a good overall picture, including the strength of the organization, was obtained by D/F-ing the locations of the radio stations.

The D/F-ing of the radio stations of TAF, especially the control stations was the most important basis for recognizing changes in concentration, preparations for large-scale attacks, etc. Important conclusions as to the order of battle of the Army were drawn from this information supplied by the Luftwaffe SIS. For

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example, it was learned that 83 Group was to work with the British 2nd Army, and 84 Group was to be with the Canadian 1st Army. The Group Headquarters were in approximately the same location as Army Hq., with whom they worked. When the Group moved, it was evident that the Army Hq. had also moved.

b) Further Observation of Manoeuvres in Great Britain.

After the organization of TAF, manoeuvres and exercises continued in Great Britain at full scale. The purpose of the exercises, as far as could be determined, was to achieve good cooperation between Air Forces and Ground Forces. Coverage of the traffic revealed the following:

- aa) As expected the stress of the ground support program was laid on the fighter and fighter bomber units. Two-engined bombers were only used to a limited extent, and no four-engined bombers were noted in these exercises. The conclusion was that the strategic air force, Bomber Command, would carry on as before, and that the support of front-line ground troops would be the task of fighter aircraft;
- bb) Tactical reconnaissance was flown almost exclusively by Mustangs, and Lysanders were practically obsolete. Artillery target-spotting missions for light and medium artillery could not be flown by the Mustangs. Therefore, special flying units, equipped with "Taylors" or "Musters", were set up as part of the artillery, and known as "AMP's". However, target-spotting for heavy artillery, which penetrated deeper into enemy territory, was still performed by Mustang units of TAF;

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cc) The change-over of tactical reconnaissance aircraft from HF to VHF also brought a change in the method of giving air support to the Army. Up to that time a number of different posts on the ground listened in on the oral reports from the reconnaissance observer. Under the new arrangement this was no longer the case. In the Mustang, however, the pilot was his own observer. After a short sortie he would return to his advanced landing-ground, and make his report after landing. Only in especially urgent cases, such as an enemy tank breakthrough, did he report immediately while still airborne.

To keep the Army units currently informed of the results of tactical reconnaissance flights, the Army Tactical Reconnaissance broadcast was introduced. All reports were first sent by W/T, and then broadcast.

When German communications broke down during the retreats in the West, these reconnaissance reports were often the only means available for providing the German High Command with a picture of the situation;

dd) The control of the British fighter and fighter bomber formations was not transferred to the advance liaison teams (tentacles), as would have been expected from the experiences in Africa, and which the Americans actually did introduce later. Instead, control remained with a central station, either at or near Army Hq. The mission of the tentacles was as follows:

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To pass back the Army's air support requests to the main fighter Control Center;

To keep the Army informed of the air situation, and the Air Force informed of the ground situation (giving changes in bomb-line etc.);

To mark off especially difficult targets with smoke grenades.

Direct R/T communication between these advance liaison teams and the airborne aircraft was noted very rarely, in contrast to the Americans.

c) Bombing Missions of TAF Along the Channel Coast.

The operational tasks of the TAF squadrons did not differ from those of RAF Fighter Command up until the invasion.

Squadrons of both commands were used in equal strength for the following purposes:

Air security patrols;
 Defense against German reconnaissance flights;
 Fighter sweeps into France;
 Fighter escort for bomber formations.

Also, there was hardly any difference in their training. Owing to the complete absence of German bombing attacks, all fighter units stationed in Southern England were trained and committed alike, for all types of missions.

7. Training Command, Maintenance Command.

Coverage of these organizations had to be dropped, mainly because of the ever-increasing strength of the operational units. Up to the middle of 1943 the organization and strength of Training Command was known, but from then on it was no longer followed. However, coverage

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of the point-to-point networks was continued, in order to keep track of the more important changes.

The different schools of Training Command, chiefly the Flying Training Units such as EFTS, AFU, and Bombardment and Gunnery Schools were spot-checked from time to time. Intercept stations in Norway ascertained the location of the schools, their strength, and to some extent the nature and duration of the courses. The traffic given the most attention was the air-to-ground R/T and W/T.

Since captured documents and PW interrogation provided ample information concerning these schools, coverage of this traffic brought little that was new. But for the Signal Intelligence Service it did have a negative value insofar as it meant that this traffic could be quickly dropped when identified.

Signal intelligence was unable to offer any useful information on Maintenance Command.

E. United States Army Air Force.

1. General.

The appearance of strong American Air Force units in Great Britain at the end of 1943 presented German signal intelligence with a new group of difficult problems. With the addition of these American units the total air strength in the United Kingdom was doubled in a very short time. This brought at least a twofold increase in the call-signs and frequencies in use. The reinforcements which accrued to the signal intelligence service were very insignificant by comparison, and the augmented task had to be compensated for by an increase in the work

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of the individual man on the set, and in the evaluation section. Less important networks such as schools, etc., were relegated to the background. At first it was very difficult to break into American radio traffic. The German SIS, used to the RAF methods, had to readapt itself before dealing with this new traffic. When the characteristics of USAAF radio traffic became known, the work progressed without much difficulty.

In retrospect, the following comparison can be drawn between RAF and USAAF traffic from the point of view of the German signal intelligence service:

USAAF traffic presented more difficulties to German SIS in the following respects:

- a) Organization, and reconstruction of chains of command was especially difficult because the 9th Air Force used Army call-signs for so long;
- b) Method of transmitting of traffic in point-to-point networks and use of link call-signs procedure made D/F-ing difficult;
- c) German voice interceptors were inexperienced in understanding the American accent;
- d) Widespread use of automatic Morse keys, especially after the landing in France; no facilities were on hand for recording this traffic.

USAAF traffic facilitated SIS evaluation in the following respects:

- a) Radio discipline was generally weaker than in the RAF; many messages were sent "in the clear";

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- b) Radio traffic was more voluminous and therefore there were greater possibilities of gaining an entry, and learning to understand the traffic;
- c) More transparent fighter control methods during combat;
- d) Less cautious use of radio and navigational aids. For example, "Mickey" and other navigational devices were often turned on, thus making it possible to D/F the aircraft;
- e) Clear and simple allocation of VHF call-signs and frequencies. No attempts at deception were made.

2. Eighth Air Force.

a) Echelons of Command, and General Observations.

The first insight into the higher-echelon organization of the 8th Air Force came from captured documents and PWI. Signal intelligence, at the time (Spring of 1943), had not yet made any progress in this direction.

After the organization of VIII Bomber Command with its four wings, and VIII Fighter Command, with its four wings, became known, it soon became possible to separate the point-to-point traffic of these two commands, including traffic of their subordinate units, from the bulk of unidentified traffic. From this point on SIS was in a position to note any changes. Some of these were:

- aa) The first appearance of the VIII Air Support Command in the Middle Wallop area in the spring of 1943;
- bb) The separation of the 3rd Bomber Wing (Marauders) from VIII Bomber Command, and incorporation into the 9th Air Force as IX Bomber Command in the fall of 1943;

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- cc) The turning over of the 70th Wing to 9th Air Force;
- dd) The assignment of fighter wings to the Bomber Divisions.

Radio traffic between 8th Air Force and USSTAF was not monitored because of the lack of suitable equipment to intercept high speed link traffic.

Monitoring of radio traffic between USA and the UK was the assignment of the fixed SIS station in Oberhaching, Bavaria, to which Referat B 5 moved in 1945. Especially good success was obtained in intercepting the air-to-ground traffic of ATC and the Ferry Command.

b) VIII Bomber Command (See Figure 3)

aa) General.

In contrast to the RAF Bomber Command, material concerning which was almost exclusively obtained from W/T, the monitoring of the VIII Bomber Command offered in addition to W/T traffic, a very voluminous R/T traffic for evaluation purposes.

The first appearance of American heavy bombers in UK was learned by the monitoring of radio traffic of the trans-Atlantic ferrying routes. While the RAF Bomber Command used the so-called "X" code, the Americans employed the "Q" code. Also trifling radio characteristics, as, for example, the use of "v" instead of "de" in the procedure signals, and the different structure of call-signs, made the American traffic easily distinguishable from the British. Captured documents, and prisoner of war interrogations, revealed that a number of British airfields had been evacuated, and made

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